Notes made when approaching the mouth of the São Francisco River, on board of the Steamer "Gequia", Tuesday, August 12th 1879.- from Maceio.

At 6 A.M., going down the Coast, five to six miles distant. When within about fifteen miles of the river, I notice immense sand-dunes bounding the horizon; showing that the land is quite low for some miles behind the Coast.

At 11, A.M., in sight of the breakers on the outer bar of the river. Our steamer is going at only half speed.

At 11.40 we pass through the breakers without difficulty in the smooth water inside.

We are now about 2 miles outside of the light-house, which stands on the upper, or northerly side of the entrance to the São Francisco River.

Just behind the light-house is an iron, spider-frame Signal station, in the midst of sand-dunes.

The entrance is not unlike that of the Columbia river in Oregon, on the Pacific Coast, in miniature; the mouth of the São Francisco being about one mile, while the mouth of the Columbia is five miles wide. The depth of water on the Columbia river bar is however from twenty four to twenty six feet; while on the São Francisco bar it is from twelve to fourteen feet.

The land is very low, and flat, on both sides of the São Francisco river, at, and for some distance above its mouth.

In fifteen minutes after passing the outer bar we were in the river, and had our river-pilot, who took the place of the Coast-pilot.

The sand-dunes referred to, continue along the Coast from the upper or northerly point first noticed all the way to the river.

These sand-dunes and the leaning Cocoa trees show that the prevailing winds are from the North and North-East.

Below the mouth of the river, along the Coast as far as I can see, sand-dunes are either absent or insignificant in size.

It is obvious that vast quantities of sand, in the course of time, are moved by the wind and blown into the mouth of the river, as well as into the river above its mouth, from the sand-dunes north of the river. Perhaps in a single year a very large quantity of sand is thus deposited; the river presenting a barrier to the further progress of the sand southward.

This sand is an addition to the other large quantity of sand and alluvial sediment brought down the river by its annual floods; all of which is carried out of the river-current and deposited at various points on the great bar; the principal places of deposit varying, at different periods, depending upon the circumstances of the floods, the tides, and the winds. The prevalence of North-Easterly winds

along the coast establishes a littoral current running Southerly, driving the Coast sands in the same direction toward the entrance of the river; where, meeting the strong out-flow of the river this littoral current is checked. The antagonism of these currents, though they are not quite equal at times, at right angles to each other, creates eddies and counter currents in front of the river entrance, where the great bar is subject to the triple action of the littoral and river currents, and the ocean waves. In the midst of this conflict the sand is at one time deposited at another time carried away; causing the channels to be more or less variable, in depth and position.

Occasional strong Southerly winds on this part of the Coast may check and even temporarily overpower the regular littoral current mentioned; but winds from the South do not appear to have had a controlling influence in forming and maintaining the general regimen of the river entrance.

Whether the quantity of sand annually blown into the river from the Coast is sufficient to call for remedial measures to stop or lessen it, is yet to be ascertained. One natural remedy, or preventive, would be, the erection of obstructive barriers north of the river, so arranged as to cause the flow of sand to curve, and be deposited along the Northerly land side, without entering the river.

At this time, vessels drawing ten or eleven feet, or more, which pass through the channel on the outer bar, ascend the river only to Ilha Grande, twelve miles above the mouth. Above the Island at this time (August 12th, 1879) vessels drawing less than twelve feet can pass to Penedo, 30 miles above the mouth; and vessels drawing six to eight feet can pass to Piranhas, 146 miles from the mouth.

The river is about two feet above its extreme lowest stage. It does not follow that the channels will have two feet less depth at extreme low water. Sometimes it is quite otherwise.

The depth of the channel through the bar (at least 12 feet) is greater than the depth of the river a few miles above, according to the statements made.

The steamer "Gaquia", in which we crossed the bar, was drawing only 10 feet; yet they stopped her twelve miles up and unloaded the cargo destined for Piranhas into strong barges, which conveyed the cargo up the river. The members of our "Commission" were put on board of a small steam yacht. Our stand at 3°. 43, and arrived at Penedo at 6°. 06 = 2°. 43- time about 17 miles.

It was about half past eight o'clock (1°. 30' P.M.) when we arrived at Ilha Grande.

Piranhas, August 13th. 1879.

Piranhas, is the practical head of navigation on the lower São Francisco, One hundred and forty six miles from its mouth. It is now the lower terminus of the Paulo Affonso Railway, which is now under construction, extending to Jatobá, its terminus on the Upper São Francisco, twenty eight miles from Piranhas. At Piranhas, therefore, all ocean and lower river freight for the Valley of the Upper São Francisco, must be transhipped.

When this railroad shall have been completed, and the Upper São Francisco ~~xxxxxxxxxxxx~~ improved, the Upper and Lower river will still present two distinct navigations; the trade and travel upon which will be conveyed over the Paulo Affonso (Portage) Railway.

Without further examination of the Lower river, and of the bar at its mouth, there are some circumstances that may be considered that ~~xxxx~~ have a bearing upon the case. From the facts now known, it is quite evident that this is a peculiar river, needing peculiar treatment.

The extent and grandeur of the navigation above the great Falls of Paulo Affonso, are entirely independent of the Lower São Francisco; as much so as if they appertained to another river.

The Lower River has to be treated by itself, with only such incidental reference to the Upper river as will naturally arise from the fact that the same volume of water ~~belongs to~~ runs through each.

The São Francisco, has been likened to the Mississippi; but when it has to be studied in order to devise improvements, it will be found to be radically different.

The Mississippi river, above the bars at its great delta, is navigable than One hundred feet deep, to the City of New Orleans, which is over a hundred miles from the Mouths of the river, and the river is of great depth for many hundred miles further up.

The Lower São Francisco river is no deeper than the Channel it holds through the bar; and, at the distance of thirty miles from its mouth, and from that point to Piranhas, 146 miles, it has less depth than the Channel through the bar, and there the navigation ceases.

Consequently, it will be useless to deepen the Channel or Channels through the bar, unless the river be deepened at the same time correspondingly. Then will arise the question to what point should it be thus deepened? To Ilha Grande? 13 miles; to Penado? 30 miles; or to Piranhas? 146 miles.

The Cost of any of such improvements, I am not yet prepared to estimate; but, independently of the Cost, the matter admits of general discussion.

Unless the river shall be deepened all the way to Piranhas, it would involve trans-shipment from larger to smaller Vessels, at the point to which it should be deepened. If so, it would seem to be unnecessary to extend the deepening any further up than to secure a good harbor for trans-shipping from larger to smaller Vessels such as could run to the Railroad Terminus at Piranhas.

Upon the extent and Character of the trade that may arise upon the Completion of the Portage Railway, and the improvement of the Upper São Francisco, may largely depend the kind and amount of improvements that should be undertaken along the Lower river, and at its bar.

Approach from the Sea, the São Francisco Bar, and the Lower River

Approach from the sea

The approach to the São Francisco River from the Ocean is very favorable. The light, which stands on the north easterly side of the mouth, at the height of (21.m) is visible (18 kilometers), toward the bar. There is a gradual decrease of depth to 5 fathoms (9.m), when within about 3 kilometers) of the Light House.

There is at this time (January, 1880) a good Channel across the bar, with a least depth of 4½ meters, high water, this least depth not more than one fourth of a mile, soon deepening, inside and outside of this bar to six, meters. This Channel has a general direct Course about north west from the ocean and pretty direct toward the entrance, where, not far from the Northern or Alagoas shore, in steering to 15, opposite the Light House there is a depth of 9 meters. The mouth of the river is a little more than One mile wide, but the navigable width inside, is narrowed by a large Sand bar on the southerly or Sergipe shore to about half a mile, leaving a clear Channel of ample width, with a Central depth of from six to fifteen meters, up to Penedo, about nine leagues, the depth in the river varies from 3 to 9 meters, the general depth being from 4 to 6 meters.

Heavy sand-dunes line the Alagoas coast for many miles North East of the river. On the Sergipe or southwesterly side the sand-dunes are much smaller. This difference is owing to the prevalence of winds from the north North East. ~~Immense clouds are formed by the wind northeast of the river, the tendency~~ their drift being toward the river. The large sand-dunes on the northeasterly side of the São Francisco river are constantly being drifted by the prevailing winds toward the river. Here their further progress southward ends, and the sand is continually blowing into the river, whence it is carried out by the river currents and dropped on the outside bar. Vast quantities of sand

* Thus forming a good harbor for vessels after crossing the bar.

Vessels coming down the coast, from the north east, by keeping or seven six miles off shore, will be outside of the 10 fathom soundings, and will clear the Japii Bank (on which there is only 4½ fathoms) before passing point Peba, ~~which~~ There outlying rocks are 2½ miles from the shore, east of the Morita das Ongas, a hillock northward of Peba Point, 9 miles S by W. ½ W. from Coripipe Point, and 10½ miles from the S. Francisco river.

are ~~[illegible]~~ accumulated along the Coast, carried to the river and blown into the stream at the entrance and for some distance above, thus adding to the other large quantity of alluvial sediment and sand brought down the river during freshets. Very little sand is blown into the stream near its mouth from the Southerly or Sergipe side, as the winds ^ ~~do not~~ rarely blow from that direction.

The prevalence of North easterly winds also establishes a littoral ^ Coast Current in the same direction, passing ^ over and in front of the river bar, driving the Coast sands along with it. This littoral Current ^ fortunately does not strike the general outflow of the river at right angles. The general Course of the river for several miles above the light-house is very little east of South, and the ~~[illegible]~~ trend of this part of the Coast is about South-West, so that during freshets the Courses of the river flow and that of the littoral Current do not differ more than about 45 degrees. This produces two effects; one is to throw the greatest accumulation of sand in the bar to the Southward of the river entrance; the other is to maintain a better depth of Channel across the bar than there would be if the two Currents were at right angles ^ at an angle or still more in opposition.

When the river is in its low stage its outflow is of course less decided, ^ and its scouring power is reduced, and its Course is more ~~[illegible]~~ deflected by the action of the Coast Current, ^ as well as by the shape of the bar; but it is then bringing no sediment from the upper river; ~~[illegible]~~ At such times the Chief accumulation of sand is from the Sand-dunes mentioned, and the Coast-^ ~~Sands~~ moving Southwestward. Much of this ^ deposit however, ^ can-does not remain permanently in the bar, ^ in front, but must pass on further ^ along the Coast. Hence the tendency is to add to the bar Southwestward, while if it increases at all North-eastward, it will be very slowly; and not any unless the General Coast ^ also is filling out.

Judging from the Charts of the Coast Survey, and the map of Engineer Halfeld, from observations made twenty six years ago, this part of the Coast has not changed very materially during that period; the general line of the Coast remains nearly the same, and the crest of the outer bar now projects only about 2 miles outside of the general Coast line.

The South western shore, from the entrance for three miles up the river is a low wholly of delta formation, island, separated from the mainland of Sergipe by an arm, called Pirapuca Creek, the outlet of which is down the coast about six miles below. This does not seem to have changed its shape perceptibly during twenty six years.

But while the general shape of the delta may change very slowly, changes in the position of the Channel through the outer bar may take place more rapidly. At present the Channel through the bar is nearly where it was twenty six years ago, but in the interim, as we are informed by an experienced Capitão who is familiar with the entrance of this river, the better Channel ran south of the large bar, which now, in low water, there is scarcely a sufficient depth for Canoes.

For some years there has been a good Channel, about where it now is, for vessels drawing ten to twelve feet to enter, at or near high tide.

Should Circumstances hereafter render it expedient to undertake any artificial works at the outer bar, a designed to permanently establish a Channel, it would be necessary to make a careful, thorough Survey of the locality.

At present the natural Channel entrance through the bar is good, and has quite as much depth as a number of places in the river a little way up, so that any vessel that can navigate the river in low water to Penedo, 9 leagues up, can pass the outer bar.

Foot Note. The São Francisco river has been likened to the Mississippi; but when studied in view of appropriate improvements it will be found that they are radically to each, different. The lower São Francisco and its mouth, are Essentially unlike the lower Mississippi and its mouths.

The Mississippi river above the head of the passes at its great delta has a depth of thirty meters or more all the way up to the City of New Orleans Kilometers above the passes, and continues very deep for several hundred kilometers farther; while the lower São Francisco, excepting a short distance inside of its bars, has no greater average depth than the channel through its outer bar, and in several places within forty kilometers of its mouth the depth is rather less during low water than the depth of the channel through the bar. The average width of the lower São Francisco is considerably greater than the average width of the lower Mississippi, the latter making up in depth what it lacks in width.

In the case of the Mississippi, the deepening of the channel through its bar was of paramount importance in order to permit the passage of the largest ocean ships through its deep channel to the great commercial port of New Orleans; but in the ~~case~~ of the São Francisco there is not depth enough in the river for large ocean ships, nor is there a great commercial port ~~on the river~~ to be reached.

At present there does not appear to be any pressing necessity for undertaking the work of deepening the channel through the São Francisco bar. Merely dredging a deeper channel would be but a temporary expedient, unless the dredging should be frequently repeated, and our experience in the United States in merely dredging at the mouths of delta rivers shows only a large expenditure for small results.

Upon the extent and character of the future trade that may arise on the lower river after the completion of the portage around the Falls and the improvement of the Upper River, will depend the kind and amount of appropriate improvements along the lower river and its bar.

It is proper to remark that no permanent material increase of depth on the São Francisco bar can be maintained without the construction of jetties, which, under existing circumstances would be premature, and